

**Notice of Allowability**

Application No.

10/801,426

Examiner

Jaime M. Holliday

Applicant(s)

NAKAYA ET AL.

Art Unit

2686

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to application filed 3/16/04.
2. ☒ The allowed claim(s) is/are 1-15.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☐ All b) ☐ Some\* c) ☒ None of the:
    1. ☒ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
  5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
    - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
    - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08),  
Paper No./Mail Date 3/16/2004
4. ☐ Examiner's Comment Regarding Requirement for Deposit  
of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413),  
Paper No./Mail Date \_\_\_\_\_
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other \_\_\_\_\_

## DETAILED ACTION

### *Priority*

1. Applicant's claim for the benefit of a prior-filed application under 35 U.S.C. 119(a)-(d) is acknowledged. Applicant has not complied with one or more conditions for receiving the benefit of an earlier filing date under 35 U.S.C. [1] as follows:

Should applicant desire to obtain the benefit of foreign priority under 35 U.S.C. 119(a)-(d) prior to declaration of an interference, a translation of the foreign application should be submitted under 37 CFR 1.55 in reply to this action.

### *Information Disclosure Statement*

2. The information disclosure statement (IDS) submitted on March 16, 2004 has been considered by the Examiner and made of record in the application file.

### *Allowable Subject Matter*

3. **Claims 1-15** are allowed and they are renumbered 1-8, 11, 12, 9, 10 and 13-15, respectively.
4. The following is an examiner's statement of reasons for allowance:  
Consider **claim 1**, the best prior art found during the examination of the present application, **Sim (U.S. Pub # 2003/0181170 A1)** in view of **Kithara (U.S. Pub #**

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**2003/0069047 A1**), fails to specifically show, disclose, or suggest weight controlling unit in a multiple-input-multiple-output wireless communication system that includes an inverse calculation unit that calculates such a channel matrix as to have all eigenvalues within a predetermined range that includes the average value of the calculated eigenvalues but does not include the smallest one of the calculated eigenvalues, and a directivity adjusting unit that adjusts the directivity of the adaptive array antenna unit, so that the current channel matrix approaches the channel matrix calculated by the inverse calculation unit.

Sim clearly shows and discloses a signal transmission apparatus for a mobile communication system in which beamforming is performed so that performance of the MIMO system can be remarkably heightened, reading on the claimed "wireless communication apparatus that is employed in a multiple-input-multiple-output wireless communication system," (abstract). The signal transmission apparatus includes a channel estimation unit for estimating a channel matrix from collected signals, and an eigen decomposition unit for eigen-decomposing the estimated channel matrix, calculating an eigenvector and an eigenvalue, reading on the claimed "eigenvalue calculating unit," (paragraph 66). The signal transmission apparatus further includes a beamforming unit **22** for performing a beamforming on each demultiplexed symbol, a plurality of transmit antennas **50** for transmitting the beamformed signals and a plurality of receive antennas **60** for collecting signals transmitted from the transmit antennas. The beamforming unit performs the beamforming by multiplying each symbol by a weight vector reading on the claimed "directivity adjusting unit that adjusts the directivity

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of the adaptive array antenna unit and the directivity being changed by varying weights with respect to the antenna elements,” (paragraph 89, 90). The signal transmission apparatus additionally includes a channel estimation unit **28** and an eigen decomposition unit **30**. The channel estimation unit estimates a channel matrix (H) from the signals collected from the plurality of receive antennas, and the eigen decomposition unit performs a eigen-decomposition on the estimated channel matrix (H) to obtain an eigenvalue and an eigenvector, and then feeds back them to the beamforming unit. Since the MIMO system is assumed to have more receive antennas (N) than the transmit antennas (M), the channel matrix (H) is not a square matrix. Thus, since the eigen decomposition unit of the receiving end is not able to eigen-decompose the channel matrix (H) itself, it performs an eigen-decomposition of  $\underline{H}^H \times \underline{H}$ , reading on the claimed “an eigenvalue calculating unit that calculates eigenvalues of a matrix represented by the product of a current channel matrix representing the transmission characteristics of wireless transmission channels of the respective antenna units and a conjugate transposed matrix of the current channel matrix,” (paragraphs 114, 115, 120).

Kithara clearly shows and discloses an adaptive array antenna directivity control system that can select a path optimum for communication. The adaptive array antenna directivity control system measures power values and arrival angles of signals of respective paths received at a plurality of antenna elements constituting an adaptive array antenna provided in a CDMA base station, executes a weight control relative to signals to be transmitted from the respective antenna elements based on the foregoing measurement results, and radio-outputs the signals as transmission signals, reading on

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the claimed "wireless communication apparatus comprising: a plurality of antenna units that transmit or receive a radio frequency signal; and a weight controlling unit that gives a weight with respect to each of the antenna units, at least one of the antenna units being formed by an adaptive array antenna unit that has a plurality of antenna elements, and directivity being changed by varying weights with respect to the antenna elements," (abstract).

Sim in view of Kithara, however, lacks the claimed inverse calculation unit, therefore this limitation, in conjunction with the other limitations recited in claim 1, is novel and unobvious in view of the combination of Sim and Kithara.

Consider **claim 13**, the best prior art found during the examination of the present application, **Sim (U.S. Pub # 2003/0181170 A1)** in view of **Kithara (U.S. Pub # 2003/0069047 A1)**, fails to specifically show, disclose, or suggest weight controlling unit in a multiple-input-multiple-output wireless communication system that includes an inverse calculation unit that calculates such a channel matrix as to have all eigenvalues within a predetermined range that includes the average value of the calculated eigenvalues but does not include the smallest one of the calculated eigenvalues, and a directivity adjusting unit that adjusts the directivity of the adaptive array antenna unit, so that the current channel matrix approaches the channel matrix calculated by the inverse calculation unit.

Sim clearly shows and discloses, in figures 3-9, a transmitting end and receiving end of the signal transmission apparatus, reading on the claimed "wireless transmission apparatus and wireless reception apparatus."


Sim in view of Kithara, however, lacks the claimed inverse calculation unit, therefore this limitation, in conjunction with the other limitations recited in claim 13, is novel and unobvious in view of the combination of Sim and Kithara.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jaime M. Holliday whose telephone number is (571) 272-8618. The examiner can normally be reached on Monday through Friday 7:30am to 4:00pm.

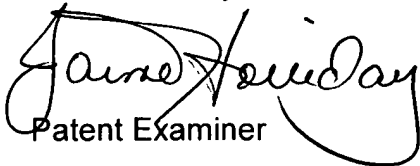
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marsha Banks-Harold can be reached on (571) 272-7905. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

  
NICK CORSARO  
PRIMARY EXAMINER

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jaime Holliday



Patent Examiner